

### **LISTING OF THE CLAIMS**

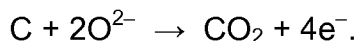
1. (original) A direct-electrochemical-oxidation fuel cell for generating electrical energy from a solid-state organic fuel comprising:

a cathode provided with an electrochemical-reduction catalyst that promotes formation of oxygen ions from an oxygen-containing source at the cathode;

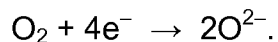
an anode provided with an electrochemical-oxidation catalyst that promotes direct electrochemical oxidation of the solid-state organic fuel in the presence of the oxygen ions to produce electrical energy; and

a solid-oxide electrolyte disposed to transmit the oxygen ions from the cathode to the anode,

wherein direct electrochemical oxidation at the anode occurs according to the reaction:



2. (original) The fuel cell according to claim 1, wherein formation of the oxygen ions at the cathode proceeds according to the reaction:



3. (original) The fuel cell according to claim 1, wherein the solid-state organic fuel is coal, graphite, biomass or a combination thereof.

4. (original) The fuel cell according to claim 3, wherein the biomass is selected from a group consisting of peat, rice hulls, and corn husks.

5. (original) The fuel cell according to claim 1, wherein the direct electrochemical oxidation at said anode produces a product comprising a  $\text{CO}_2$  concentration of at least 50 mol %.

6. (original) The fuel cell according to claim 1, wherein the electrochemical-reduction catalyst is lanthanum strontium manganese oxide.

7. (currently amended) The fuel cell according to claim 1, wherein the electrochemical-reduction catalyst is selected from ~~the group consisting of LSF; LSCF; SSC;~~  $\text{La}_{0.8}\text{Sr}_{0.2}\text{FeO}_3$  (LSF);  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Co}_{0.2}\text{O}_3$  (LSCF);  $\text{Sm}_{0.5}\text{Sr}_{0.5}\text{CoO}_3$  (SSC);  $\text{YBa}_2\text{Cu}_3\text{O}_y$ , wherein y is an integer having values within a range of ~~7-9~~ 7 to 9;  $\text{La}_{0.99}\text{MnO}_3$ ;  $\text{LaMnO}_3$ ;  $\text{La}_x\text{Sr}_y\text{Mn}_3$  and  $\text{La}_x\text{Ca}_y\text{MnO}_3$ , wherein x is a number having values within a range of ~~0.6-0.95~~ 0.6 to 0.95, and y is a number having values within a range of ~~0.1-0.4~~ 0.1 to 0.4.

8. (currently amended) The fuel cell according to claim 1, wherein the electrochemical-reduction catalyst is selected from ~~the group consisting of~~ a material having a general formula of  $\text{A}_x\text{B}_y\text{CO}_3$ , wherein A is selected from ~~the group consisting of~~ La, Gd, Sm, Nd, Pr, Tb and Sr, B is selected from ~~the group consisting of~~ Sr, Ce, and Co, x is a number having values within a range of ~~0.6-0.94~~ 0.6 to 0.94, and y is a number having values within a range of ~~0.1-0.4~~ 0.1 to 0.4.

9. (original) The fuel cell according to claim 1, wherein the electrochemical-oxidation catalyst provided to the anode includes platinum.

10. (currently amended) The fuel cell according to claim 1, wherein the electrochemical-oxidation catalyst includes ~~Rhenium~~ rhenium.

11. (original) The fuel cell according to claim 10, wherein the electrochemical-electrochemical oxidation catalyst is Re-NiO/YSZ.

12. (original) The fuel cell according to claim 10, wherein the electrochemical-oxidation catalyst is Cu oxide-Pt.

13. (currently amended) The fuel cell according to claim 1, wherein the solid-oxide electrolyte is selected from the group consisting of doped oxides of Bi, Zr, Hf, Th, and Ce with either alkaline earth oxides such as CaO or MgO, or rare-earth oxides ~~such as selected from~~  $\text{Sc}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , and  $\text{Yb}_2\text{O}_3$ , ~~and the like. For example, embodiments of the present invention include a solid-oxide electrolyte 18 comprising at least one of~~  $\text{Bi}_{2.7}(\text{Bi}_{2.7})_{0.75}(\text{Y}_{2.3})_{0.25}$ ,  $\text{BaTh}_{0.9}\text{Gd}_{0.1}\text{O}_3$ ,  $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_3$ ,  $(\text{Ce}_{2.7})_{0.8}(\text{GdO}_{0.5})_{0.2}$ ,  $(\text{ZrO}_{2.7})_{0.9}(\text{Sc}_{2.3})_{0.4}$ ,  $(\text{ZrO}_{2.7})_{0.9}(\text{Y}_{2.3})_{0.4}$ ,  $(\text{ZrO}_{2.7})_{0.87}(\text{CaO})_{0.13}$ ,  $(\text{LaO}_{2.3})_{0.95}(\text{SrO})_{0.05}$ .

14. (original) The fuel cell according to claim 1, wherein the solid-oxide electrolyte is selected from the group consisting of yttrium-stabilized zirconium and bismuth oxide.

15. (original) The fuel cell according to claim 1, further comprising a housing that encloses the anode for receiving the solid-state organic fuel.

16. (original) The fuel cell according to claim 15, further comprising feed passage through which the solid-state organic fuel can be inserted into the housing.

17. (original) The fuel cell according to claim 1, wherein the electrochemical oxidation that occurs at the anode produces a product comprising a  $\text{NO}_x$  concentration of less than 5 mol %, wherein x is an integer within a range of 1 to 3.

18. (original) The fuel cell according to claim 17, wherein the fuel cell has a maximum operating temperature of about 1200°C.

19. (original) The fuel cell according to claim 1, wherein the direct electrochemical oxidation that occurs at the cathode results in a product comprising a CO concentration that is less than 10 mol %.

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20. (original) The fuel cell according to claim 19, wherein the fuel cell has a maximum operating temperature of about 1200°C.

21. (original) The fuel cell according to claim 1, wherein the fuel cell produces an electrical current of at least 100 mA/cm<sup>2</sup> for a period of time lasting at least 48 hours.

22. (original) The fuel cell according to claim 1, wherein the fuel-conversion efficiency of the fuel cell is at least 30 mol % at 950°C.

23. (original) A direct-electrochemical-electrochemical oxidation fuel cell for generating electrical energy from a solid-state organic fuel comprising:

a cathode provided with an electrochemical-reduction catalyst that promotes the formation of ions from an ion source at the cathode;

a anode provided with an electrochemical-oxidation catalyst that includes a sulfur-resistant material and promotes electrochemical oxidation of the solid-state organic fuel in the presence of the ions formed at the cathode to produce electrical energy; and

a solid-oxide electrolyte disposed to transmit the ions from the cathode to the anode.

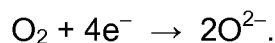
24. (original) The fuel cell according to claim 23, wherein the sulfur-resistant material includes at least one of Re, Mn and Mo.

25. (currently amended) The fuel cell according to claim 24, wherein the sulfur-resistant material is selected from the group consisting of Re-NiO/YSZ and Cu oxide-Pt.

26. (original) The fuel cell according to claim 23, wherein the electrochemical-reduction catalyst is lanthanum strontium manganese oxide.

27. (currently amended) The fuel cell according to claim 23, wherein the electrochemical-reduction catalyst is selected from the group consisting of LSF; LSCF; ~~SSC~~;  $\text{La}_{0.8}\text{Sr}_{0.2}\text{FeO}_3$  (LSF);  $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Co}_{0.2}\text{O}_3$  (LSCF);  $\text{Sm}_{0.5}\text{Sr}_{0.5}\text{CoO}_3$  (SSC);  $\text{YBa}_2\text{Cu}_3\text{O}_y$ , wherein y is an integer having values within a range of ~~7-9~~ 7 to 9;  $\text{La}_{0.99}\text{MnO}_3$ ;  $\text{LaMnO}_3$ ;  $\text{La}_x\text{Sr}_y\text{Mn}_3$  and  $\text{La}_x\text{Ca}_y\text{MnO}_3$ , wherein x is a number having values within a range of ~~0.6-0.95~~ 0.6 to 0.95, and y is a number having values within a range of ~~0.1-0.4~~ 0.1 to 0.4.

28. (original) The fuel cell according to claim 23, wherein the ions formed at the cathode are oxygen ions formed according to the reaction:



29. (original) The fuel cell according to claim 23, wherein the solid-state organic fuel is coal, graphite, biomass, polymers or a combination thereof.

30. (currently amended) The fuel cell according to claim 29, wherein the biomass is selected from ~~a group consisting of~~ peat, rice hulls, and corn husks.

31. (currently amended) The fuel cell according to claim 23, wherein the solid-oxide electrolyte is selected from the group consisting of doped oxides of Bi, Zr, Hf, Th, and Ce with either alkaline earth oxides such as CaO or MgO, or rare-earth oxides such as selected from  $\text{Sc}_2\text{O}_3$ ,  $\text{Y}_2\text{O}_3$ , and  $\text{Yb}_2\text{O}_3$ , and the like. ~~For example, embodiments of the present invention include a solid-oxide electrolyte 18 comprising at least one of~~  $\text{Bi}_2\text{O}_{2.7}$ ,  $(\text{Bi}_2\text{O}_3)_{0.75}(\text{Y}_2\text{O}_3)_{0.25}$ ,  $\text{BaTh}_{0.9}\text{Gd}_{0.1}\text{O}_3$ ,  $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_3$ ,  $(\text{Ce}_{0.2})_{0.8}(\text{GdO}_{0.5})_{0.2}$ ,  $(\text{ZrO}_2)_{0.9}(\text{Sc}_2\text{O}_3)_{0.1}$ ,  $(\text{ZrO}_2)_{0.9}(\text{Y}_2\text{O}_3)_{0.1}$ ,  $(\text{ZrO}_2)_{0.87}(\text{CaO})_{0.13}$ ,  $(\text{La}_2\text{O}_3)_{0.95}(\text{SrO})_{0.05}$ .

32. (original) The fuel cell according to claim 31, wherein the solid-oxide electrolyte is selected from the group consisting of yttrium-stabilized zirconium and bismuth oxide.

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33. (original) The fuel cell according to claim 23, wherein electrochemical oxidation of the solid-state organic fuel at the anode produces a product having a CO<sub>2</sub> concentration of at least 50 mol %.

34. (original) The fuel cell according to claim 33, wherein the fuel cell has a maximum operating temperature that is less than 1200°C.

35. (original) The fuel cell according to claim 23, wherein electrochemical oxidation of the solid-state organic fuel at the anode produces a product having a NO<sub>x</sub> concentration that is less than 0.1 mol %, wherein x represents integers ranging from 1 to 3.

36. (currently amended) The fuel cell according to claim 23, wherein the electrochemical-oxidation catalyst is selected from the group consisting of a noble metal, group VIII metal/metal oxide, such as Pt, Cu, Ag, Au, Pd, Ni, oxides of the aforementioned sulfur-resistant materials, oxides of Ce, Cr, Fe, and Pb, combinations thereof, multiple oxides, combinations including one or more of the aforementioned metals, Cu oxide-Pt, and Re-NiO/YSZ, wherein the electrochemical-oxidation catalysts including non-noble metals also include a sulfur-resistant substance selected from the group consisting of Re, Mn, Mo, Ag, Cu, and Au.

Claims 37 through 40, cancelled.

41. (new) The fuel cell according to claim 13, wherein the solid oxide electrolyte comprises at least one of Bi<sub>2</sub>O<sub>2</sub>, (Bi<sub>2</sub>O<sub>7</sub>)<sub>0.75</sub>(Y<sub>2</sub>O<sub>3</sub>)<sub>0.25</sub>, BaTh<sub>0.9</sub>Gd<sub>0.1</sub>O<sub>3</sub>, La<sub>0.8</sub>Sr<sub>0.2</sub>Ga<sub>0.8</sub>Mg<sub>0.2</sub>O<sub>3</sub>, (Ce<sub>2</sub>)<sub>0.8</sub>(GdO<sub>0.5</sub>)<sub>0.2</sub>, (ZrO<sub>2</sub>)<sub>0.9</sub>(Sc<sub>2</sub>O<sub>3</sub>)<sub>0.1</sub>, (ZrO<sub>2</sub>)<sub>0.9</sub>(Y<sub>2</sub>O<sub>3</sub>)<sub>0.1</sub>, (ZrO<sub>2</sub>)<sub>0.87</sub>(CaO)<sub>0.13</sub>, (La<sub>2</sub>O<sub>3</sub>)<sub>0.95</sub>(SrO)<sub>0.05</sub>.

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42. (new) The fuel cell according to claim 31, wherein the solid oxide electrolyte comprises at least one of  $\text{Bi}_2\text{O}_2$ ,  $(\text{Bi}_2\text{O}_7)_{0.75}(\text{Y}_2\text{O}_3)_{0.25}$ ,  $\text{BaTh}_{0.9}\text{Gd}_{0.1}\text{O}_3$ ,  $\text{La}_{0.8}\text{Sr}_{0.2}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_3$ ,  $(\text{Ce}_2)_{0.8}(\text{GdO}_{0.5})_{0.2}$ ,  $(\text{ZrO}_2)_{0.9}(\text{Sc}_2\text{O}_3)_{0.1}$ ,  $(\text{ZrO}_2)_{0.9}(\text{Y}_2\text{O}_3)_{0.1}$ ,  $(\text{ZrO}_2)_{0.87}(\text{CaO})_{0.13}$ ,  $(\text{La}_2\text{O}_3)_{0.95}(\text{SrO})_{0.05}$ .